NOTES TO ARCHITECT

SECTION 03300 - CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 GENERAL CONDITIONS

As specified in Section 00700.

1.02 RELATED WORK SPECIFIED ELSEWHERE

Resilient flooring and accessories, including floor leveling and patching compounds and testing for moisture and alkalinity is provided under SECTION 09650 - RESILIENT TILE FLOOR.

1.03 STORAGE OF MATERIALS

A. Cement and aggregates shall be stored in such a manner as to prevent their deterioration or the intrusion of foreign matter. Any material which has deteriorated or which has been damaged shall not be used for concrete and shall be promptly removed from the site.

1.04 TESTS

A. Slump: Standard slump tests as described in ASTM C143 (Modification: Sampling of concrete for slump test shall be taken after at least 1/4 cubic yard of concrete has been discharged) will be made periodically during the placement of concrete by the Engineer to ensure that the slump for which the concrete has been designed is met. Any concrete batch tested and showing slumps exceeding the specified tolerance shall be rejected. Any concrete placed prior to slump testing shall be the sole responsibility of the Contractor and shall be rejected should the subsequent slump test of the batch in question indicate that the slump tolerance is being exceeded. All rejected concrete shall be promptly removed and properly replaced. All costs resulting therefrom shall be borne by the Contractor.

B. Compressive Strength: During the progress of the work, compressive strength tests of concrete shall be made **by the Engineer. The number of strength tests of each class of concrete placed each day shall be no less than:**

a. One per day, nor less than,
b. One for each 150 cubic yards of concrete placed, nor less than,
c. One for each 5,000 square feet of surface area of slabs or walls placed.

The use of this specification must be tailored to your job. This specification covers normal weight concrete, not lightweight structural concrete nor prestressed concrete members.

The intent of the specified requirements regarding concrete strength, water-cement ratio and entrained air is to provide concrete slabs-on-grade with a max. vapor transmission level of 5#/1000 s.f. which is acceptable for resilient tile flooring installation. If other flooring materials having a lower vapor transmission level requirement is to be used (e.g. sheet vinyl flooring), the consultant shall amend the specifications as necessary to attain the necessary vapor transmission resistance level.

However, since moisture related flooring problems are not experienced on all projects, the consultant shall verify if the project is located in an area which has experienced such problems in the past. If not, the specification should be amended to reduce the concrete strength to 3,000 psi w/o the addition of entrained air.

If the total volume of concrete is such that the frequency of testing as required above would provide less than five strength tests for a given class of concrete, tests shall be made from at least five randomly selected batches or from each batch if fewer than five batches are used.

If the total quantity of concrete placed on a project is less than 50 cubic yards, the Engineer may waive the strength tests.

1. **A strength test shall be the average of the strengths of two cylinders made from the same sample of concrete tested at 28 days or at the test age designated for determination of compressive strength. The strength of an individual class of concrete shall be considered satisfactory if both of the following criteria are met:**

   a. **No single strength test (i.e. the average of the strengths of two cylinders) shall be more than 500 psi below the specified compressive strength; and**

   b. **The average of any three consecutive strength tests shall be equal or greater than the specified compressive strength.**

2. The Engineer will make and identify all test cylinders. The Contractor shall provide the equipment, such as a shovel and a wheelbarrow for the Engineer to make and move the cylinders, and shall also provide the labor and equipment to deliver the cylinders to the testing laboratory as directed by the Inspector.

3. Cost of testing will be borne by the State.

4. The standard age for testing the cylinders shall be 28 days. However, 7-day tests may be made for indication of final 28-day strengths.

5. All cylinders shall be made and cured in accordance with ASTM C31.

6. In all cases where the strength **level** of any **class** of **concrete** falls below the minimum compressive strength specified, the Engineer shall have the right to require that test

specimens be cut from the structure. Specimens shall be selected by the Engineer from the location in the structure represented by the test specimen or specimens which failed.

Specimens shall be secured, prepared, and tested in accordance with ASTM C42 within a period of 60 days after placing the concrete. The testing shall be done by a laboratory approved by the Engineer. Concrete in the area represented by the core tests will be considered structurally adequate if the average strength of 3 cores is no less than 85% and the strength of a single core is no less than 75% of the 28-days strength specified. Should laboratory analysis indicate, however, that the proper concrete mix has not been used by the Contractor, all such concrete placed using the improper mix shall be subject to rejection. The cost of cutting specimens from the structure, patching the resulting holes, and making the analysis, including laboratory and consultation costs, shall be borne by the Contractor.

The holes from which the cored samples are taken shall be packed solid with no-slump concrete proportioned in accordance with the ACI 211.3 "Standard Practice for Selecting Proportions of No-Slump Concrete". The patching concrete shall have an "extremely dry" consistency and the same design strength as the specified concrete.

7. If the strength of the specimens cut from the structure falls below the requirements stipulated above, the Engineer shall have the right to require any and all defective concrete to be replaced, and all costs resulting therefrom shall be borne by the Contractor.

PART 2 - PRODUCTS

Change designation of cement type to fit design.

2.01 MATERIALS

A. Portland Cement shall conform to the requirements of ASTM C150, Type I, for all concrete work.

B. Concrete Aggregates:

1. Fine Aggregates shall be calcareous or basalt

NOTES TO ARCHITECT

sands, or a combination thereof. They shall meet the grading requirements of ASTM C33 unless the concrete producer can provide past data that shows that a proposed non-conforming gradation will produce concrete with the required strength and suitable workability.

If manufactured sands are used in the concrete mix, the Contractor may select and use a water-reducing and/or an air-entraining admixture as specified hereinafter to provide satisfactory workability in the concrete. The cement content of a mix shall be as specified hereinafter, and the use of an admixture shall in no way result in the reduction of the cement factor.

2. Coarse Aggregates shall be crushed close-grained, blue lava rock meeting the grading requirements of sizes 57 or 67 (ASTM D448) or both. The maximum size of aggregate shall not be larger than 1/5 of the narrowest dimensions between sides of the forms of the member for which the concrete is to be used nor larger than 3/4 of the minimum clear spacing between individual reinforcing bars or bundles of bars.

C. Water used in mixing concrete shall be clean and free from injurious amounts of oils, acids, alkalis, salts, organic materials or other substances that may be deleterious to concrete or reinforcement. Non-potable water shall not be used.

D. Concrete Splash Blocks shall be standard units, 12" x 16" x 4" thick.

E. Expansion Joint Filler: A pre-molded material of 1/2" thickness, unless otherwise noted, composed of fiberboard impregnated with asphalt conforming to ASTM D 1751.

F. Joint Sealing Compound shall be a polysulfide or urethane compound conforming to ASTM C 920 or other approved equal, compatible with the floor finish to be applied. Color to be selected by the Engineer.

G. Bond-Break Filler: Mineral-surfaced roofing cap sheet or coated asphalt felt.

Specify appropriate ASTM designation for expansion joint filler and sealing compound where material other than that shown is used.

Delete paragraph where colored concrete finish is not being provided.

NOTES TO ARCHITECT

H. Colored Concrete shall be obtained by the application of a dry powder or approved equal pigment into fresh concrete slabs.

I. Non-Slip Grit shall be an abrasive aggregate of silicon carbide or aluminum oxide.

J. Admixture, if used, shall conform to ASTM C494 or ASTM C260 and shall be mixed in proper amount in accordance with directions of manufacturer.

K. Curing Compound shall be compatible with the floor finish to be applied. Unless otherwise required by the floor finish, the compound shall conform to the requirements of ASTM C 309.

L. Pervious Sheeting shall be burlap or other acceptable absorbent material, free from substances that will harm the concrete or cause discoloration.

M. Moisture Barrier shall be of Polyethylene film, minimum 0.010" thick.

N. "Keyed Kold Joint" shall be galvanized.

O. Cementitious Coatings shall be cement based polymer modified cement finishing materials ("Pro-Finish" by Bonded Materials Company, "Polycoat" by Tremcrete Systems Incorporated, "Durus" by Durus High Tech Cement, or approved equal).

P. Engineered Synthetic Fiber Reinforcement shall be 100% virgin polypropylene fibrillated fibers containing no reprocessed olefin materials. Fibers shall have a specific gravity of 0.91, and specifically manufactured to an optimum gradation and length for use as concrete secondary reinforcement. Fiber reinforced concrete shall meet the requirements of ASTM C-1116, Type III, Synthetic Fiber-Reinforced Concrete or Shotcrete.

PART 3 - EXECUTION

3.01 DESIGN OF CONCRETE MIXES

A. Ingredients for concrete shall be Portland cement, fine and coarse aggregates and water.

B. Normal weight concrete shall meet the requirements outlined in Subsection C, D and E below.

C. Concrete shall be designed so that the concrete

Modify this paragraph and specify appropriate slumps to suit job requirements. Consider workability, especially on slabs, narrow members and flatwork. For mix

NOTES TO ARCHITECT

materials will not segregate nor cause excessive bleeding. Slump shall be 4 inches. A tolerance of 1" above the indicated slump will be allowed for individual batches.

For concrete used in ramps or other sloping construction, the slump tolerance shall be waived.

designs with high range water reducers, specify maximum slump with added restriction that no segregation occurs.

D. Slabs-on-grade shall have a maximum water-cement-ratio of 0.50 and shall contain 4% ± 1-1/2% entrained air.

For severe exposure conditions, provide appropriate water/cement ratio controls.

E. For concrete designed for specified strengths in excess of 4,500 psi and/or containing admixtures other than those used exclusively for the purpose of entraining air, mixture proportions to provide the desired characteristics shall be developed in accordance with Sections 5.2, 5.3 and 5.4 of ACI 318-89.

F. The Contractor shall submit for approval by the Engineer the mixes he intends to use at least 14 days before the actual concrete placing operations.

Note classes of concrete to be used on plans.

G. The Contractor shall use only approved mixes.

H. Unless otherwise noted, Class 4,500 concrete shall be used for slabs built on-grade, Class 3,000 concrete for all non-prestressed structural slabs, beams, piers, columns, stairs, walls, footings and equipment pads above ground; Class 2,500 concrete for sidewalks, equipment pads on grade, and other uses not included under the Classes noted above.

For slabs-on-grade, the contractor may use a mix design other than that described above provided the vapor emission rate is equal or less than 5 lbs. per 1000 s.f. at the time of the finished flooring installation. If the vapor emission rate exceeds this limit, the Contractor shall be responsible to take the measures necessary to reduce the emission to an acceptable level without delaying the project.

I. Engineered Synthetic Fiber Reinforcement shall be added to all concrete sidewalks on grade.

NOTES TO ARCHITECT

3.02 JOINTS

A. Construction joints shall be provided as detailed at locations indicated on the plans. Construction joints not shown on the plans shall be so made as to least impair the strength of the structure and shall be approved by the Engineer. In general, they shall be located near the middle of the spans of slabs, beams and girders unless a beam intersects a girder at this point, in which case the construction joints in the girders shall be offset a distance equal to twice the width of the beam. Joints in columns and walls shall be at the underside of floors, slabs, beams or girders and at the top of footings or floor slabs. Beams, girders, brackets, column capitals, haunches and drop panels shall be placed at the same time as slabs. Joints shall be perpendicular to the main reinforcement.

B. All reinforcing steel shall be continuous across construction joints. Keys and/or inclined dowels shall be provided as required. Longitudinal keys at least 1-1/2" deep shall be provided in all joints in walls and between walls and slabs or footings. Unless otherwise indicated, joints shall be sealed with joint sealing compound.

Locate and detail expansion joints on plans.

C. Expansion joints shall be provided as detailed at locations indicated on the plans. Reinforcement or other embedded metal items bonded to the concrete (except dowels in floors or walls bonded on only one side of joint) shall not be permitted to extend continuously through any expansion joint. Joints shall be sealed with expansion joint filler and sealing compound at least 3/8" deep.

Location of control/contraction joints shall be in accordance with ACI 302.1. Indicate location on plans.

D. Contraction/control joints shall be provided where shown on the plans and shall be 1/4 the depth of the slab or a minimum of 1" deep. Unless otherwise indicated on the plans, joints may either be tooled, formed-in-place or sawcut. When saw-cut joints are provided, cutting shall be timed properly with the set of the concrete so that it is firm enough not to be torn or damaged by the cutting blade and before random shrinkage cracking can form in the slab. In any case, cutting shall be completed not later than 12 hours after the concrete is placed and finished. Unless otherwise indicated on the plans, joints shall be sealed with joint sealing compound.

Modify paragraph to provide type of control joint applicable to your project. Detail joint as necessary on the plans.

3.03 MIXING CONCRETE

A. All concrete throughout shall be either job or plant mixture in an approved type of power operated mixer that will ensure uniformity and homogeneity of the concrete produced. The Contractor shall provide a sufficient number of mixers to continuously carry on the work.

B. Mixing at jobsite shall be done in accordance with ACI 304 and as follows:

1. Concrete shall be thoroughly mixed in a batch mixer of an approved type and size which will insure a uniform distribution of materials throughout the mass. The machine shall have a control device to prevent materials from being discharged until they have been mixed for the specified minimum time.

2. The entire contents of the drum shall be discharged before materials of the succeeding batch are placed therein. No mixer shall be used which has a rated capacity of less than a 1-sack batch and no mixer shall be charged in excess of its rated capacity.

3. The first batch of materials placed in the mixer after the machine has been cleaned shall contain a sufficient excess of cement, sand and water to coat the inside of the drum without reducing the required mortar content of the mix. Upon cessation of mixing, the mixer shall be throughly cleaned.

C. Ready Mixed and Mixed-In-Transit Concrete shall be mixed to conform to the provisions of ASTM C94 and as follows:

1. The plant shall have sufficient capacity and transportation equipment to deliver concrete at the rate desired. The interval between batches for a pour shall not exceed 30 minutes.

2. The time elapsed between the introduction of the mixing water to the cement and aggregates or the cement to the aggregates, and the placing of concrete in its final position shall not exceed 90 minutes.

3. In hot weather (more than 90 degrees fahrenheit ambient temperature) or under conditions contributing to quick stiffening of the concrete, the elapsed time in 2. shall not exceed 60 minutes, if no retarding admixture is used. If an ASTM C494 Type B or

NOTES TO ARCHITECT

D admixture is added to the concrete, the elapsed time in 2. shall remain at 90 minutes.

4. Synthetic fibers for fiber reinforced concrete shall be added at the batch plant at a rate of 1.5 lbs. per cubic yard.

D. Concrete shall be mixed only in such quantity as is required for immediate use. No retempering will be permitted and concrete that has started to harden shall be discarded and promptly removed from the job.

E. Admixtures conforming to Paragraph 2.01 may be used in the concrete as recommended by the supplier and approved by the Engineer.

F. Hand mixing of concrete will not be permitted except to make up shortages for fence post footings, sidewalks, thresholds, flag pole foundations, curbs and gutters, and thrust blocks.

3.04 PLACING CONCRETE

A. No concrete shall be placed in the absence of the Engineer or his representative who shall be given one day advance notice of starting time of concrete pour.

Place no concrete until foundation, forms, reinforcing steel, pipes, conduits, sleeves, hangers, anchors, inserts, waterproofing, termite treatment and/or basaltic termite barrier and other work required to be built into or placed ahead of concrete placing have been inspected and approved by the Engineer. Concrete placed without such notice and approval shall be rejected.

B. Preparation

1. All sawdust, chips and other construction debris and extraneous matter shall be removed from interior of forms. Struts, stays, bracing, or blocking serving temporarily to hold forms in correct shape or alignment shall be removed when the concrete placing has reached an elevation rendering their services unnecessary.

2. Concrete shall be placed upon clean, damp surfaces with no free water, or upon properly compacted fills but never upon soft mud or dry, porous earth. Before pouring footings or foundations, bottoms of excavations shall

Modify specification as

NOTES TO ARCHITECT

be properly leveled off and tamped.

3. Before depositing new concrete on or against concrete which has set, all accumulations of mortar splashed upon reinforcing steel and the surfaces of forms shall be removed and the forms shall be retightened. The surfaces of previously set concrete shall be thoroughly roughened and cleaned of all foreign matter and laitance, saturated with water and slushed with a coat of cement grout. New concrete shall be placed before the grout has attained its initial set.

required when epoxy bonding of new to old concrete is required, such as in rainy areas like Hilo.

C. Conveying

1. Concrete shall be conveyed from mixer to forms as rapidly as practicable by methods that will prevent segregation.

2. Concrete shall be deposited as nearly as practicable in its final position. Extensive spading as a means of transportation shall be avoided and in no case shall vibrators be used to transport concrete inside the forms.

3. Open troughs and chutes shall have a slope not to exceed 1 vertical to 2 horizontal and not less than 1 vertical to 3 horizontal. Chutes more than 20 ft. long and chutes not meeting the slope requirements may be used provided they discharge into a hopper before distribution.

4. The concrete shall not be allowed to drop freely more than 6 feet except where specifically authorized by the Engineer. When placing operations would involve the dropping of concrete from a height of more than 6 feet, it shall be conveyed through pipes or flexible drop chutes.

5. If any appreciable segregation occurs through the conveying methods employed, their use shall be ordered discontinued by the Engineer and some other satisfactory method of placing concrete shall be used.

6. All chutes, troughs, pipes and other means of conveyances shall be kept clean and free from coatings of hardened cement or concrete by thoroughly cleaning with water and chipping after each pour. Water used for flushing shall be discharged away from the vicinity of the concrete or forms already in place.

Incorporate supplementary specification when concrete is to be placed below water table.

NOTES TO ARCHITECT

D. Depositing

If placing underwater, specify concrete to be placed by pumping or tremie techniques. Reference: Chapter 8, ACI 304 "Guide to Measuring, Mixing, Transporting, and Placing Concrete".

1. Unless adequate protection is provided, concrete shall not be placed during rain. Rainwater shall not be allowed to increase the mixing water nor to damage the surface finish. Fresh concrete that has been deposited but has not attained its initial set shall be protected in the event of rain.

2. Concrete shall be placed so as to avoid segregation of the materials and the displacement of the reinforcing. As nearly as practicable, the concrete shall be dropped vertically without hitting reinforcement, sleeves or forms into its final position in order to avoid separation of coarse aggregates from concrete. After the initial set of concrete, the forms shall not be jarred and no strain shall be placed on the projecting reinforcing.

3. Formed concrete shall be deposited in horizontal layers not deeper than 2 feet avoiding inclined layers and inclined construction joints. The depth of layers shall be shallow enough so that the succeeding layer will be placed before the previous layer has attained its initial set.

   Concrete shall not be allowed nor shall it be caused to flow horizontally or on slopes in the form. Concrete placing on a slope shall begin at the lower end of the slope and progress upward.

4. Construction joints shall be made only where located on the plans unless approved otherwise by the Engineer. Pours shall be planned to provide for the continuous placing of concrete from one construction joint to another. The face edges of all joints that are exposed to view shall be carefully finished true to line and elevation.

5. In slab construction, placing of the concrete shall be started at the far end of the work so that each batch will be dumped against

When concrete of higher

NOTES TO ARCHITECT

previously placed concrete, not away from it. The concrete shall not be dumped in separate piles and the piles then leveled and worked together. For floor slabs on earth, additional requirements in Paragraph 3.05 shall apply.

6. Beams and girders shall not be placed at the same time as the supporting columns or walls. At least 2 hours must elapse after columns or walls are placed before placing beams and girders supported thereon.

7. Columns shall be placed in approximately 4-foot sections, with each section being vibrated and compacted as placed.

8. In placing a deck of slabs and beams, the beams shall be placed first up to the height of the bottom of the floor slab. This placement shall extend in bay modules and end at the midspan, midpoint between columns. The length of this placement shall be determined by the time it takes to return to the slab and the top layer of the beams before the top of the first pour has started to harden and form a cold joint.

9. If depositing of concrete must be stopped short of a full placement, it shall be leveled to a horizontal plane or stopped against a vertical bulkhead. Such bulkhead or horizontal plane shall be located only as approved by the Engineer.

strength is to be used for compression members together with lower strength concrete for flexural members, add supplementary specifications to clarify connection points.

E. Compaction

1. All concrete shall be consolidated by vibration so that the concrete is thoroughly worked around the reinforcement, around embedded items, and into corners of forms, eliminating all air or stone pockets which may cause honeycombing, pitting, or planes of weakness. All compaction shall be done by use of high frequency internal vibrators. Where the vibrator cannot be inserted into the concrete, compaction shall be done by spading, rodding or forking.

NOTES TO ARCHITECT

2. Frequency of vibrator shall be not less than 7,000 inpulses per minute. The Contractor shall provide a sufficient number of vibrators to properly consolidate all concrete immediately after placing. At least one standby vibrator shall be on hand at all times during placement of the concrete.

3. Vibration shall not be applied through contact with reinforcement of forms. Vibration shall penetrate previously deposited concrete sufficiently to prevent pockets or voids or construction joints from occurring between pours, but must not be applied to concrete which has set up sufficiently to cease to be plastic under vibration.

Leave out the phrase "...except where finish is to be a floor covering" where the slab will be in many and/or large areas, such as Industrial Arts Classrooms and Dining Rooms.

3.05 FLOOR SLABS ON EARTH

A. Concrete floor slabs on grade, with the exception of sidewalks, shall be placed directly over a moisture barrier overlain atop basaltic termite barrier specified in another section. The edges of the moisture barrier shall be lapped a minimum of 12 inches and sealed with tape or by other acceptable means. Floor slabs shall not be placed before the roof is in place except where finish is to be a floor covering or when otherwise noted on the plans.

Show dowel detail on plans.

Design reinforcement for special conditions, such as poor foundation, thicker slabs, or slabs other than shown.

B. All earth-supported slabs, with the exception of sidewalks, shall be reinforced with Grade 60 #3 steel reinforcing bars at 15" o.c. each way unless otherwise shown or called for on the plans. Plain bar dowels shall be provided as detailed for construction and expansion joints. Such dowels shall be wrapped or greased on one side of the joints to prevent bonding.

Indicate location on plan detail or call out in specs.

Location of control/contraction joints shall be in accordance with ACI 302.1. Indicate location on plans (especially aournd columns and at corners).

C. Care shall be taken in handling and placing the reinforcement. Reinforcement shall be positively set to the level required within the slab(s) as indicated on the plans.

D. Floor slabs shall be placed in alternate panels, long strip pattern, following construction or expansion joints. Narrow contraction/control joints shall be provided transverse to the length of the cast strips. There shall be an

interval of at least 2 days between the placing of the initial panels and that of the adjacent ones. "Keyed Kold Joint" may be used in lieu of placement in alternate panels in areas where floor covering is specified provided all shrinkage cracks are sealed prior to installation of floor covering. As an option, slabs may be placed in alternate panel checkerboard pattern. Where slabs are placed in a checkerboard pattern, no panel shall be placed in excess of 500 square feet in area nor exceed 32 feet in its longest dimension.

Show detail on plans.

E. A bond-break filler shall be provided where edge of slab abuts any vertical surface and where indicated on plans. Width of filler strips shall equal depth of floor slab.

F. Prior to concrete placement, the basaltic termite barrier material shall be wet down, tamped and screeded to minimize its disturbance. Small mounds of concrete shall be placed at random rebar intersections during the pour to provide support in addition to the chairs or blocks. Reinforcing bars shall be lifted as necessary to ensure proper placement within the slab.

Fiber reinforcement is intended to provide secondary reinforcement only. Provide and indicate steel reinforcement on the drawings where pavement will be subject to vehicular traffic loads or where poor soil conditions exist. Where dowels are required to prevent vertical displacement, provide details on the drawings.

3.06 CONCRETE SIDEWALKS ON GROUND

A. Concrete walks shall be of one lift construction, 4 inches in thickness with thickened edge, and reinforced with synthetic fiber reinforcement. Keys and /or plain bar dowels shall be provided as detailed for construction and expansion joints. Such dowels shall be wrapped or greased on one side of the joint to prevent bonding.

Show other locations for expansion joints if necessary.

B. Expansion joints shall be provided as detailed, not more than 32 feet apart; at junctions with curbs; where walks abut buildings, platforms and other fixed structures; and elsewhere as shown in the plans. Reinforcement or other embedded metal items bonded to the concrete (except dowels in floors or walls bonded on only one side of joint) shall not be permitted to extend continuously through any expansion joint. Joints shall be sealed with expansion joint filler and sealing compound at least 3/8" deep.

Location of control/contraction joints shall be in accordance with ACI 302.1. Indicate location on plans.

Modify paragraph to provide type of control joint applicable to your project. Detail joint as necessary on the plans.

C. Contraction/control joints shall be provided where shown on the plans and shall be 1/4 the depth of the slab or a minimum of 1" deep. Unless otherwise indicated on the plans, joints may either be tooled, formed-in-place or sawcut. When saw-cut joints are provided, cutting shall

be timed properly with the set of the concrete so that it is firm enough not to be torn or damaged by the cutting blade and before random shrinkage cracking can form in the slab. In any case, cutting shall be completed not later than 12 hours after the concrete is placed and finished. Unless otherwise indicated on the plans, joints shall be sealed with joint sealing compound.

Show detail section as necessary on plans.

D. Concrete shall be tamped and screeded true to grade and section, sufficient mortar brought to the surface for finishing, and the required finish given as specified hereinafter before the concrete sets. Steps in connection with walks shall have same finish as walks. All edges except for those at saw-cut control joints shall be rounded to 1/8" radius. Cross slope for sloped or crowned walks shall be 5/32" per foot. No pedestrian traffic shall be permitted on concrete walks for a period of 3 days after placing.

Show or call for scoring on plans.

E. Walks shall be finished as indicated hereinafter and scored where shown or called for on the plans.

3.07 FINISHING OF SLABS

A. Finish A - Scratched Finish. After the concrete has been placed, struck off, consolidated and leveled, the surfaces shall be roughened with stiff brushes or rakes (cross-scratched) before final set.

B. Finish B - Light Trowelled Finish. After the concrete has been placed, struck off, consolidated and leveled, the concrete shall not be worked further until ready for floating. Floating shall begin when the water sheen has disappeared and/or when the mix has stiffened sufficiently to permit the proper operation of a power-driven float. The surface shall then be consolidated with power-drive floats of the impact type except in thin sections. Hand floating with wood or cork-faced floats shall be used in locations inaccessible to the power-driven machine. The slab shall then be steel trowelled to a uniform, smooth texture.

Modify specification as required when concrete hardener is to be used.

C. Finish C - Trowelled Finish. The surface shall be finished first with impact power floats, as

specified above for Finish B, then with power trowels and finally with steel hand trowels. The first trowelling after power floating shall be done by a power trowel and shall produce a smooth surface which is relatively free of defects but which may still contain some trowel marks.

Additional trowelling shall be done by hand after the surface has hardened sufficiently. The final trowelling shall be done to a point when a ringing sound is produced as the trowel is moved over the surface. The finished surface shall be free of any trowel marks and shall be uniform in texture and appearance. On surfaces intended to support floor coverings, any defects of sufficient magnitude to show through the floor covering shall be removed by grinding.

Due to potential non-uniformity of colors and higher construction and maintenance costs, colored slabs shall not be specified unless absolutely required.

D. Finish D - Broom Finish. The concrete slab shall be given a coarse transverse scored texture by drawing a broom across the surface. The operation shall follow immediately after steel-trowelling performed under Finish B above.

E. Finish E - Color Finish. Prior to application of the colored finish, the color finish manufacturer's representative shall instruct the finish applicator in the proper application and curing of the color material. The manufacturer's representative shall also be present during application of the color material to ensure compliance with the manufacturer's instructions.

Unless otherwise required by the color finish manufacturer, the coloring material shall be applied immediately after preliminary wood floating and after any free water has evaporated or been removed. The material shall not be cast into standing water. Approximately 2/3 of the blended material required for total coverage shall be dusted onto the surface by a method that ensures even coverage without segregation.

Power floating (or wood floating) shall begin immediately after this first application. The surface shall not be trowelled. After the material has been embedded by floating, the remainder of the blended material shall be distributed at right angles to the previous application. A small portion of material shall be witheld from this second application for final touch-up of non-uniform or weak-toned areas.

The second application shall be heavier in any areas not sufficiently covered by the first application. A second power floating (or wood floating) and then trowelling shall immediately follow application. Care shall be taken not to over-trowel the surface as this will produce dark burnt areas. For exterior surfaces, a fine soft-bristled dust broom shall be drawn over the surface to produce a roughened texture. The application and rate of application of the coloring material shall be in strict accordance with the manufacturer's recommendations for a heavy-duty application. The surface shall be cured and sealed in strict accordance with the manufacturer's recommendations

Water shall not be added to the surface during application of the color hardener.

F. Finish F - Non-Slip Finish. The surface shall be given a dust-on application of abrasive aggregates. Finish with steel trowel but avoid over-trowelling. The rate of application of abrasive aggregates shall be not less than 25 pounds per 100 square feet or application shall be in strict accordance with the manufacturer's recommendations.

Revise tolerance shown to suit specific project conditions.

G. Finish G - Swirled Finish. After the concrete surface has been struck off, darbied, power floated and steel troweled, the surface shall be given a swirl float finish. The float should be worked flat on the surface in semi-circular or fan-like motion.

H. Finishing Tolerances for slabs shall be in accordance with the following:

1. Finish shall be true planes within + or - 1/4" in 10 ft., as determined by a 10-ft. straightedge placed anywhere on the slab in any direction.

Modify and/or add other items to list as required for your project.

Unless otherwise shown on the plans, all slabs shall meet this tolerance. The tolerances will be checked prior to removing of forms or shores.

3.08 SELECTION OF FLOOR FINISHES

A. Unless otherwise indicated on the plans, the following floor finishes shall be used:

1. Finish A - Scratched Finish. For surfaces intended to receive bonded applied cementitious applications (such as setting beds for ceramic tile or quarry tile on the first floor, where no membrane is called for).

2. Finish B - Light Trowelled Finish. For surfaces intended to receive roofing, waterproofing and membrane (such as setting beds on membranes, second floor and above).

3. Finish C - Trowelled Finish. For interior floors (including refrigerator floor) and floors intended to receive floor coverings.

4. Finish D - Broom Finish. For first floor lanais or walks.

5. Finish E - Colored Finish. See Finish Schedule.

6. Finish F - Non-Slip Finish. For platforms, interior and exterior steps, landings and ramps.

7. Finish G - Swirled Finish. For upper floor lanais or balconies.

3.09 REPAIR OF DEFECTS

A. After forms have been removed, any concrete which is not constructed as shown on the plans or is out of alignment or level beyond required tolerances or which shows a defective surface which in the opinion of the Engineer cannot be properly repaired or patched shall be removed.

B. Where cast-in-place concrete which is exposed to view or designated architectural requires repairing or patching, the texture of the surface of such repair or patch shall closely match that of the surrounding surface. If the concrete is to remain unpainted, the surface color shall also be closely matched to that of the surrounding surface.

C. All tie holes and all repairable defective areas shall be patched immediately after form removal as follows:

1. All honeycombed concrete shall be chipped out to sound concrete but in no case to a depth of less than 1 inch. If possible, edges of the chipped-out areas shall be undercut.

2. Rock pockets, form tie holes, deep holes not too large in area, other holes with relatively high ratio of depth to area, and similarly confined areas shall be dry packed.

   After the area to be patched has been thoroughly cleaned and dampened, mortar, which shall consist of 1 part cement, 2-1/2 parts sand passing a #16 screen, and only enough water to produce a mortar that will stick together upon being molded into a ball by slight pressure of the hands, shall be placed in the holes in layers having a compacted thickness of about 3/8". Each such layer shall be solidly rammed over its entire surface using a hardwood stick and a hammer.

3. Shallow depressions where lateral restraint cannot be obtained, voids behind reinforcement, and holes extending <u>through</u> concrete sections shall be patched using a commercially prepared bonding agent, a stiff mortar mix of 1 part cement and not more than 2-1/2 parts sand.

   For filling holes in exterior surfaces, an epoxy bonding agent shall be used. Application of the bonding agent shall be in strict conformance with the manufacturer's instructions.

4. An epoxy-and-sand mixture may be used in lieu of the mortar-and-bonding agent mixture for any of the patching above. The preparation of the surface to receive the patch, as well as the mixture proportions of the epoxy-and-sand, shall be in strict conformance with the manufacturer's instructions.

D. Except for concrete required to be removed under Paragraph 3.09A, any concrete which is not constructed as shown on the plans or is out of alignment and/or level beyond allowable tolerances may be patched using an epoxy-and-sand mixture.

The proportions of the mix and the preparation of the surface to receive the patch shall be in strict conformance with the manufacturer's instructions except as or unless otherwise specified herein. The minimum thickness of the patch shall be 1/4". No "feathering" to a lesser thickness will be permitted.

Misalignment which requires correction more than 1 inch thickness shall be repaired in the following manner:

1. The surface of the affected area shall be chipped, etched, or otherwise cleaned and roughened to provide a sound surface for bonding;

2. Concrete nails or other fasteners which can provide positive mechanical bonding of the patch shall be set into the surface at about 18 inches o.c. in all directions with a minimum of 2 rows;

3. Wire mesh reinforcement as approved by the Engineer shall be installed in those portions of the patch which exceed 2-inch thickness;

4. A bonding agent suitable for use in the repair location (epoxy required for exterior use) shall be applied over the entire surface to be patched;

5. Formwork to the true lines called for shall be installed over the area requiring the patch; and

6. Concrete or grout with aggregate sized appropriately for the cavity and which will provide strength equivalent to that of the base surface shall be placed in the form, properly compacted and suitably cured.

3.10 SURFACE FINISHES

A. Rough Concrete Finish. Rough concrete finish surfaces shall be reasonably true to line and plane with no specific requirements for selected facing materials. Tie holes, honeycombing and defects shall be patched in accordance with

NOTES TO ARCHITECT

Paragraph 3.09C herein except that the patches for concealed surfaces need not be matched in color and texture with adjacent surfaces. Fins exceeding 1/4" in height shall be removed. Otherwise, surfaces shall be left with the texture imparted by the forms.

Be sure to specify cement rubbed finish on surfaces of exposed prestressed and/or precast members in appropriate section(s).

B. Plywood Finish. Finish of all exposed surfaces cast against forms constructed of plywood or lined with "Plyform" shall be true to line and plane within the tolerances in Section 03100, Paragraph 3.01.

1. Joint marks and fins shall be removed and surfaces left smooth, dense and free from prominent grain markings.

2. The surface shall be scrubbed to remove any laitance or loose particles and to expose any defects.

3. Tie holes, honeycombing and defects shall be repaired in accordance with Paragraph 3.09C herein.

4. The surface shall be thoroughly wetted. Then, as the concrete approaches surface dryness, a mortar consisting of 1 part Portland cement, 2 parts well-graded sand passing a No. 30 sieve, and enough water to provide the consistency of thick paint shall be vigorously and thoroughly rubbed over the area with clean burlap pads so as to fill all voids.

5. While the mortar is still plastic but partially set so that it cannot be easily pulled from the voids, the surface shall be rubbed again with a dry (no water) mortar mix of the same proportions as above. Burlap pads, stretched tightly around a board to prevent dishing the mortar in the voids, shall be used for this operation. There shall be no discernible thickness of mortar on the surface, except in the voids, when this operation is concluded.

6. Immediately following the rubbing treatment, the surface shall be continuously moist-cured for 72 hours.

7. In lieu of the rubbing treatment noted above,

NOTES TO ARCHITECT

a cementitious coating in accordance with Subsection 2.01 O. may be used. Surface preparation, mixing, application and curing of the coating material shall be in strict accordance with the manufacturer's instructions and recommendations.

Modify list and/or add other items as required.

8. Exterior wall surfaces above the third floor and not adjacent to walking areas need not be treated as specified in Subparagraphs 4. to 7. above.

3.11 LOCATION OF SURFACE FINISHES

A. Unless otherwise indicated on the plans, the location of formed surface finishes shall be as follows:

1. Rough Concrete Finish - All concealed concrete surfaces such as behind ceramic tile, furring, acoustical tile, etc.

2. Plywood Finish - All exposed concrete surfaces.

3.12 CURING AND PROTECTION

A. All concrete shall be cured for a period of not less than 7 days by one of the methods listed below. During this curing period, the concrete shall be maintained with minimal moisture loss at a relatively constant temperature. Fresh concrete shall be protected from heavy rains, flowing water, mechanical injury, and injurious action of the sun. Curing method selected must be compatible with the finish to be applied to the concrete.

Delete this paragraph for short time frame projects which cannot accomodate the 90 day period noted.

Curing shall immediately follow the finishing operation.

To promote drying of slabs on grade to receive floor finish and avoid moisture related flooring problems, once drying of the slab has started, it shall be protected from getting wet for a minimum of 90 days immediately prior to the placement of the floor finish. If the slab cannot be adequately protected, mechanical

drying or other means shall be employed to reduce the vapor emission level to 5 lbs. per 1000 s.f. or less prior to placement of the floor finish.

B. Water Curing - If cured with water, concrete shall be kept wet by mechanical sprinklers, by ponding, or by any other method which will keep the surfaces continuously wet.

C. Saturated Sand Curing - Surfaces cured with sand shall be covered with a minimum of 1-inch thickness of sand which shall be kept uniformly distributed and continuously saturated during the entire curing period.

D. Pervious Sheeting - Overlap sheeting edges approximately 6 inches and keep sheets continuously wet throughout the curing period.

E. Curing Compounds - Curing compounds used on concrete surfaces that are to receive floor covering, paint or colored finish or acid stain shall be as recommended by the manufacturer to be compatible with the applied finish.

The Contractor shall submit to the Engineer a letter certifying that the curing compound is compatible with the applied finish. Application shall be in accordance with the manufacturer's recommendations. If curing, sealing or other compounds are used which are incompatible with applied finish, such compound shall be thoroughly removed by grinding with a terrazzo grinder or other means approved by the Engineer.

F. Waterproof Paper - Waterproof paper or opaque polyethylene film conforming to ASTM C171 may be used. The paper or film shall be anchored securely and all edges sealed or applied in such a manner as to prevent moisture escaping from the concrete. Waterproof paper shall not be used on floors that will be exposed when finished.

3.13 CONCRETE FOR ELECTRICAL WORK

A. Unless otherwise noted on plans, concrete for handholes and manholes shall be 3,000 psi strength at 28 days. Concrete for encased ducts shall be Class 2,500. Maximum size of aggregates for concrete encased duct shall be 3/4".

B. All ducts shall have a minimum cover of 3 inches of concrete. Spacers shall be used for placing ducts and for rigidly holding the ducts during

the concrete pour. Provide minimum earth cover of 18 inches over top of concrete encasement unless otherwise shown on plans.

C. The encased section of ducts to which a future connection is to be made shall end with a coupling. An unencased 1-foot section of duct and end cap shall constitute the terminus of such ducts.

3.14 CONCRETE FOR DRAINAGE, SEWER AND PLUMBING SYSTEMS

A. Unless otherwise noted on plans, all concrete required for construction of manholes, catch basins, foot baths, valve boxes, etc., which are required for plumbing and drainage installations shall be Class 3,000.

B. Normal weight concrete containing calcareous coarse aggregates shall not be used in sewerage structures and/or components.

C. Sewer manholes shall be constructed in accordance with Section 23 SEWER MANHOLES of the "STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION" dated September 1986, as amended. (Paragraphs concerning Measurements and Payments in the Section are not applicable to this project.)

3.15 CLEAN UP

Contractor shall clean up all concrete and cement materials, equipment and debris upon completion of any portion of the concrete work and upon completion of the entire concrete and related work.

END OF SECTION